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ANALYSIS OF KNOWLEDGE ACCOMPLISHMENT OF AN UNDERGRADUATE ENGINEERING COURSE BASED ON ATTAINMENT OF COURSE OUTCOMES

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ABSTRACT

During the beginning of the course, an articulation matrix specifying the number of hours for each course outcome and the evaluation scheme for all outcomes were specified. Based on the marks obtained by students in first and second sessional tests, assignments and end semester examination, normalized value of course outcome attainment score were evaluated. Knowledge accomplishment of an undergraduate course has been analysed based on individual CO attainment through normalized marks for each CO – direct method / predefined rubric and conclusions were drawn on attainment of course outcomes.

Key words: OBE, Articulation matrix, Grades, Course Outcomes.

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1. INTRODUCTION

In the recent years, emphasis has been given for outcome based education. In this regard, national and international accreditation bodies have revised the procedures for awarding accreditation certificates based on outcome based teaching learning process. Since last four years, our Institute has espoused Outcome Based Education (OBE) approach in teaching learning process. These outcomes for each course need to be measured and used for continual quality improvement. OBE focuses on outcomes that are identified and measured. These outcomes attribute, generally in form of information, skill, knowledge, which prepares the graduates for their professional practice [1]. The outcomes are normally looked at 3 different

levels, at course level (Course Outcomes), at program level (Program Outcomes), and at professional level (Program Objectives).

This paper describes a method that is used to analyse or the attainment of course outcomes (COs) of a specific course. CO is one of the feature that provide big picture about the expectations students have fulfilled after completing the course [2-3]. The evaluation of whether COs attained is essential in determining the student achieving in a particular course. The result of CO attainment will also be used to evaluate the attainment of Program Outcomes (PO). This analysis will help in improving the teaching and learning process in the particular course [4,5].

2. METHODOLOGY

The attitude in evaluating the attainment of CO is using formal assessment procedure data from students' marks, such as from the first and second sessional tests, assignments and end semester results. The course chosen is "Microwave Components and Devices" taught for sixth semester B.Tech students. At the beginning of the semester, based on the course outcomes specified in the syllabus and the course plan issued to the students, a course articulation matrix was prepared highlighting the number of hours for each CO, weightage of marks for sessional, assignment and end semester examinations [6,7]. The course outcomes have been shown in Table 1A and the articulation matrix has been shown in Table 1B. Rubric for Individual CO attainment through normalized marks for each CO with direct method has been shown in Table 2.

Table 1A. Course outcomes

CO1: Evaluate different parameters of Transmission lines.
CO2: Describe Smith Chart and measurement of transmission line parameters.
CO3: Discuss TE, TM, TEM waves in infinite conducting planes and in wave guides.
CO4: Describe working of Passive microwave components and their applications.
CO5: Analyse different microwave devices

Table 1B. Course Articulation Matrix

Course Outcome	**No of contact hours**	**Weightage of Marks**								**Total Marks**
		SESSIONAL		**Assignment / Quiz**					**End Semester**	
		I	**II**	**1**	**2**	**3**	**4**	**5**		
CO1	05	11		1					10	22
CO2	05	09		1					10	20
CO3	10		10		2				10	22
CO4	10		10			2			10	22
CO5	10						2	2	10	14
Total										100

Table 2 Individual CO attainment through normalized marks for each CO – direct method

Rubric				
Particulars	**Excellent**	**Good**	**Satisfactory**	**Needs Improvement**
Individual CO	≥ 0.75	≥ 0.6 & < 0.75	≥ 0.45 & < 0.60	< 0.45
Average Pass Grade	≥ 7	7 to 6	6 to 5	< 5
Pass Percentage	≥ 90	90 to 75	75 to 60	< 60

Totally 56 students spread across A section have been assessed based on the distribution of marks as per articulation matrix. Two sessional tests 20 marks each, totalling to 40 marks, assignment for 10 marks and end semester examination for 50 marks were conducted. It was ensured that question papers of all these tests, assignments and examinations cover one or more number of Cos [8,9,10]. The evaluations have been carried out by more than one faculty to ensure transparency in evaluation process. Table 3, show marks scored by students of section A in the end semester examinations.

ECE-304 Microwave Components and Devices

Table 3 Marks scored by students of a section

	CO1	**CO2**	**CO3**	**CO4**	**CO5**		**Total**
A section	**Q1**	**Q2**	**Q3**	**Q4**	**Q5**	**Q6**	
	10 Marks	**10 Marks**	**10 Marks**	**10 Marks**	**10 Marks**	**10 Marks**	**50 Marks**
Student 1	2	1	2	3	2.5	2	11.5
Student 2	8.5	9	9.5	5.5	0	8.5	41
Student 3	7	0	4.5	5	1	4.5	22
Student 4	3.5	5.5	6	1.5	1.5	0	18
Student 5	7	0	3.5	3	4	3.5	21
Student 6	8	7.5	7.5	7.5	0	6.5	37
Student 7	8	5	9	6.5	0	5.5	34
Student 8	6	8	9	9.5	0	9	41.5
Student 9	4	0	0	5.5	2.5	5.5	17.5
Student 10	0.5	0	0.5	1	0	2.5	4.5
Student 11	0	2	5	2	1.5	0.5	11
Student 12	6	6.5	5.5	9.5	6	0	33.5
Student 13	7	8	4.5	0.5	9	9.5	38
Student 14	9	0	9	7.5	10	9	44.5
Student 15	8	5	5	6	0	6	30
Student 16	1	1	2	0	3.5	2	9.5
Student 17	8	5.5	0	10	8.5	8.5	40.5
Student 18	5	1	0	1	3	1.5	11.5
Student 19	0	3	9.5	7	6.5	6	32
Student 20	6	5	6.5	3	0	3	23.5
Student 21	10	4	7	9	7.5	1.5	37.5
Student 22	4	2	0.5	0	0	0	6.5
Student 23	6	1	6.5	5.5	5.5	0	24.5
Student 24	7	7	8.5	8	0	7	37.5
Student 25	7	3	10	9.5	0	2.5	32
Student 26	8	5	5.5	8	0	6	32.5
Student 27	7	7	6	9	0	5.5	34.5
Student 28	6	3	5	6	2	0	22
Student 29	8	6	6	6.5	0	5	31.5
Student 30	9	5	9.5	8.5	9	9	45
Student 31	0	3	2	5	4	4	18

Student 32	8	5	2	5.5	8.5	8.5	35.5
Student 33	6	6	4	4.5	4.5	0	25
Student 34	6	2	9	6.5	7	3	31.5
Student 35	2	2	0	3.5	3	2	12.5
Student 36	3	0	1	4	6	0	14
Student 37	8	6	8	5.5	0	9.5	37
Student 38	9	8	6.5	0	8.5	9	41
Student 39	5	1	7	8.5	5.5	4.5	30.5
Student 40	3	0.5	5.5	9.5	4	0	22.5
Student 41	8	6.5	5.5	8.5	0	3.5	32
Student 42	7	3	4	5.5	4.5	1	24
Student 43	0	4	7	5.5	6	6	28.5
Student 44	0	3	6.5	8	2.5	6.5	26.5
Student 45	3	1	1	5.5	0	4.5	15
Student 46	0	3.5	5.5	6	2.5	2	19.5
Student 47	5	2	7	5.5	0	4.5	24
Student 48	0	6	8	6	7	6.5	33.5
Student 49	4	4	8	5	0	3	24
Student 50	0.5	0	0.5	0	0.5	1	2.5
Student 51	5.5	1	5.5	4	1.5	1.5	18
Student 52	2	5.5	6	6	1.5	4.5	24
Student 53	5	0	5	5	7.5	1.5	24
Student 54	4	1.5	4	1.5	0	1	12
Student 55	7	7	9.5	9.5	8.5	0	41.5
Student 56	1	1.5	3	0	1	2	8.5
Average	4.857	3.559	5.321	5.595	3.535	3.726	25.5

3. RESULTS AND DISCUSSION

The CO attainment of section ‘A’ in sessional test 1 has been shown in the Figure 2 and 3.

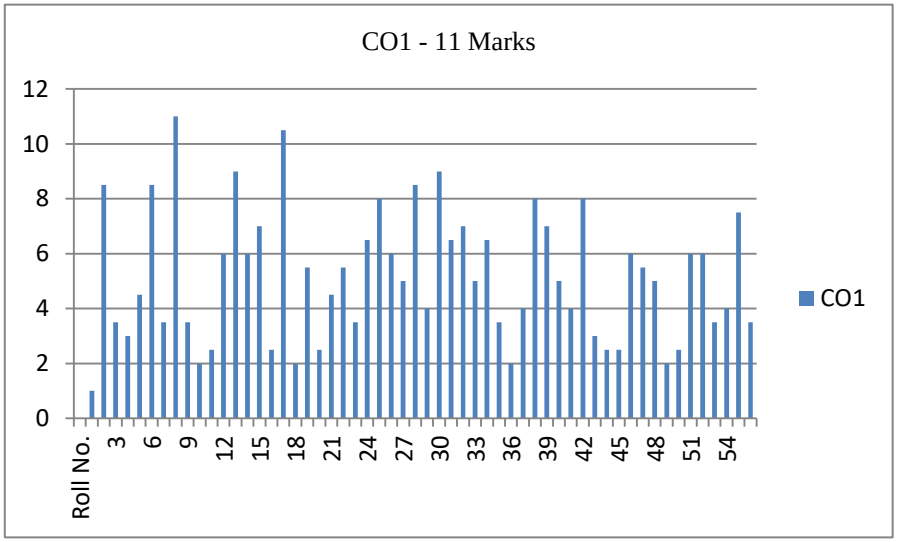

Figure 2 Test 1 CO attainment – Section A

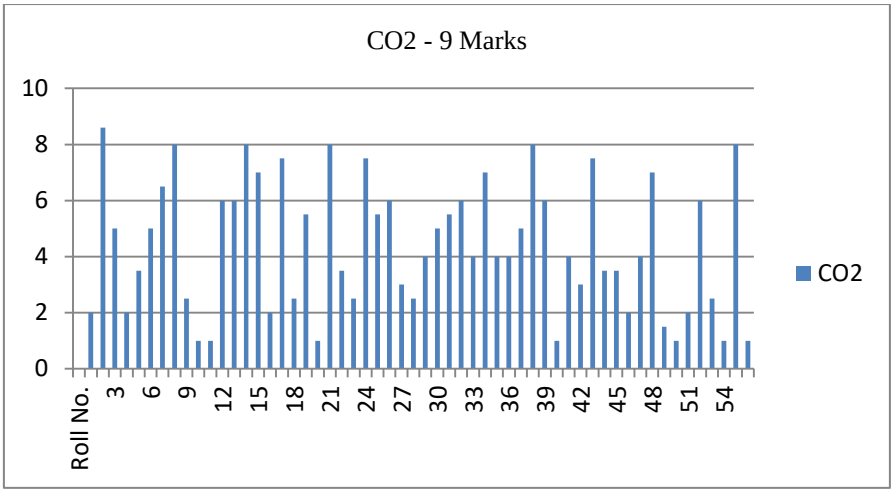

Figure 3 Test 1 CO attainment – Section A

Based on the marks scored by the students in sessional tests, assignments and end semester examinations, average normalized attainment value for each Cos were calculated for section A and the same have been shown in Table 4.

Table 4 Average CO attainment Section A

Department of Electronics and Communication Engineering										
Semester & section:VI A			Subject:MCD				Faculty: GSN			
	CO mapping									
	Cos	1	2	3	4	5	6			
I Test	Max. marks	11.0000	9.0000							
	Average mark	5.1600	4.3900							
	Normalized value	0.4700	0.4700							
II Test	Max. marks			10.0000	10.0000					
	Average mark			6.2200	6.6200					
	Normalized value			0.6500	0.6300					
ASSIGN	Max. marks	2.0000	2.0000	2.0000	2.0000	2.0000				
	Average mark	1.8500	1.7500	1.6800	1.7100	1.93				
	Normalized value	0.9250	0.8750	0.8400	0.8550	0.965				
End exam	Max. marks	10.00	10.00	10.00	10.00	20.00				
	Average mark	5.06	3.65	5.33	5.41	7.08				
	Normalized value	0.51	0.41	0.53	0.54	0.354				
Av. of normalized value		0.6350	0.5850	0.6730	0.6750	0.6590				

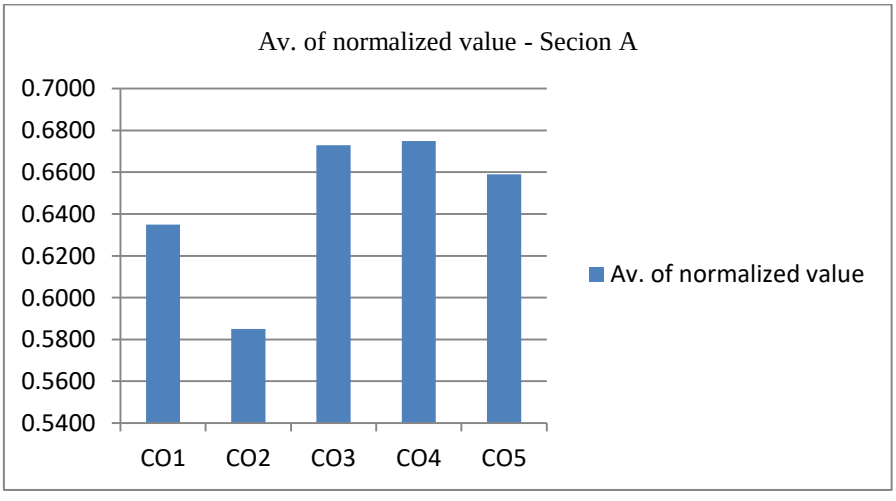

Figure 4. Average of normalized CO attainment Section A

Table 5 Average normalized CO attainment section A

CO1	Good
CO2	Satisfactory
CO3	Good
CO4	Good
CO5	Good

From Figure 4, normalized CO attainment has been verified against rubric and analysis has been shown in Table 5. However for CO2, the result is not encouraging. Since the CO emphasizes more on mathematical analysis and understanding, students may have found it difficult to solve them. This has been taken into consideration by faculty for future course of teaching learning process. However average pass grade and pass percentage are within expectation levels and are shown in Table 6.

Table 6 Consolidated CO attainment through pass-grade and pass percentage

Average pass grade	7.78	Excellent
Pass Percentage	87%	Good

4. CONCLUSIONS

Using standard Microsoft tools, a technique has been developed to find CO attainment for a specific course has been addressed in the paper. This method offers a standard and planned way to analyze the attainment outcomes for each course. The students' marks from sessional tests, assignments and end semester examination are used to calculate the CO-mark for that particular course. From this result, the attainment of each course outcome for the course can be further studied and analyzed. Action plan to improve any weakness can be identified and implemented in the following semester.

The system has been found to be very helpful in the analysis process. Using this system, the faculty could key in the relevant data and obtain the CO attainment for his or her course. This system is continuously being improved and helpful features are being added from time to time.

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